

**FLOODPLAIN MANAGEMENT STRATEGIES  
LINCOLN, NEBRASKA  
PLANNING ASSISTANCE TO STATES-SECTION 22 STUDY  
OCTOBER 2001**

**PURPOSE AND AUTHORITY**

The purpose of this study is to identify options for obtaining credit towards the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program (NFIP) Community Rating System (CRS) and to determine flood plain management strategies utilized by other communities throughout the United States.

These tasks will assist the City of Lincoln, Nebraska in the development of new Floodplain Ordinances. This study will be completed as part of the Corps of Engineers Planning Assistance to States Program, commonly referred to as the Section 22 Program. Section 22 of Public Law 93-251 authorizes the Corps of Engineers to cooperate with states in the preparation of comprehensive plans for development, utilization and conservation of the water and related resources of drainage basins located within the boundaries of the state and submit to Congress reports and recommendations with respect to appropriate Federal participation in carrying out the plan.

**THE NATIONAL FLOOD INSURANCE (NFIP) PROGRAM**

The National Flood Insurance Act of 1968 was enacted by Title XIII of the Housing and Urban Development Act of 1968 to provide previously unavailable flood insurance protection to property owners in flood-prone areas. The Flood Disaster Protection Act of 1973 requires the purchase of flood insurance on and after March 2, 1974, as a condition of receiving any form of Federal or federally-related financial assistance for acquisition or construction purposes with respect to insurable buildings and mobile homes within an identified special flood hazard area that is located within any community participating in the NFIP<sup>1</sup>.

**National Flood Insurance Program Definitions**

The base flood elevation is the elevation of the base or 100-year flood as designated on the community's Flood Insurance Rate Map (FIRM). The NFIP regulations require that new buildings and substantial improvements to existing buildings in the Special Flood Hazard Area have their lowest floors (including basement) at or above the base flood elevation. Non-residential buildings must be elevated or flood proofed to or above the base flood elevation<sup>2</sup>.

A substantial improvement is defined as any reconstruction, rehabilitation, addition, or other improvement to a building, the cost of which equals or exceeds 50% of the market value of the building before the start on construction of the improvement. If a building is substantially improved, the NFIP regulations require that it be treated as a new building and be elevated (non-residential buildings may be flood proofed) to or above the base flood elevation<sup>2</sup>.

## **COMMUNITY RATING SYSTEM**

The City of Lincoln, Nebraska participates in the NFIP that is administered by FEMA. The NFIP regulations require that new buildings and substantial improvements to existing buildings be protected from the base flood. There are a variety of reasons why a community would want to enact regulatory floodplain standards that are higher than the minimum NFIP requirements. For example, a flood could be greater than the predicted 100-year flood. The flood hazard can be increased by urbanization and other changes in the watershed, such as filling and other development in the fringe that reduces flood storage capacity<sup>2</sup>.

The NFIP's Community Rating System (CRS) provides insurance premium rate reductions to encourage communities to enact regulatory floodplain standards that are higher than the minimum NFIP requirements. More restrictive state or local regulatory standards take precedence and are encouraged by the NFIP regulations<sup>2</sup>. Many communities throughout the United States have more restrictive regulatory standards in place that enable the community to wisely manage the floodplains and obtain insurance premium rate reductions for those structures in the community that have flood insurance.

Under the CRS, flood insurance rates can be reduced according to a credit-based classification system. There are ten classes, with Class 1 having the greatest rate reduction and Class 10 having no premium credit. A community's CRS class is based on the number of credit points calculated for the activities that are undertaken to achieve the goals to reduce flood losses, facilitate accurate insurance ratings, and promote the awareness of flood hazards and flood insurance.

The CRS schedule identifies 18 creditable activities, organized under four categories in Sections 300 through 600: Public Information, Mapping and Regulations, Flood Damage Reduction, and Flood Preparedness. Communities are invited to propose alternative approaches to these activities in their applications. Communities should prepare and implement those activities that best deal with their local problems, whether or not they are creditable under the CRS. Few, if any, of the CRS activities will produce premium reductions equal to or in excess of their implementation costs. In considering whether to undertake a new floodplain management activity, a community must consider all of the benefits the activity will provide (not just premium reductions) in order to determine whether it is worth implementing<sup>2</sup>.

Currently, the City of Lincoln has 1,093 credited points out of a possible 13,315 in the CRS and is rated as a Class 8. This qualifies Lincoln residents for a 10% premium credit for flood insurance. In order to qualify for a Class 7 rating, Lincoln would need 1500 credited points in the CRS and must have received a classification of 6 or better under the Building Code Effectiveness Grading Schedule (BCEGS). The BCEGS measures a community's building code adoption and enforcement as they relate to natural hazards mitigation. A Class 7 rating in the CRS would qualify Lincoln residents for a 15% premium credit for flood insurance. Table 1 shows the CRS Classes, premium reduction, and number of credited points needed.

**TABLE 1-CRS CREDIT POINTS, CLASS, AND PREMIUM REDUCTION**

<b>Credit Points</b>	<b>Class</b>	<b>Premium Reduction</b>
4,500+	1	45%
4,000-4,499	2	40%
3,500-3,999	3	35%
3,000-3,499	4	30%
2,500-2,999	5	25%
2,000-2,499	6	20%
1,500-1,999	7	15%
1,000-1,499	8	10%
500-999	9	5%
0-499	10	0

**REGULATORY STANDARDS THAT ARE HIGHER THAN THE MINIMUM NFIP REQUIREMENTS**

There are more restrictive regulatory standards that can be implemented that would increase the natural functions of floodplains. Floodplain management activities provide enhanced public safety, a reduction in damage to property and public infrastructure, avoidance of economic disruption and losses, reduction of human suffering, and protection of the environment. Floodplains perform certain natural and beneficial functions that cannot be duplicated elsewhere. Floodwaters can spread over a large area in floodplains that have not been encroached upon. This reduces velocities and provides flood storage to reduce peak flows downstream. Natural floodplains reduce wind and wave impacts and their vegetation stabilizes soils during flooding. Water quality is improved in areas where natural cover acts as a filter for runoff and overbank flows; sediment loads and impurities are also minimized. Floodplains can act as recharge areas for groundwater and reduce the frequency and duration of low flows of surface water. They provide habitat for diverse species of flora and fauna and are particularly important as breeding and feeding grounds<sup>3</sup>.

**Freeboard**

In A Zones where base flood elevations have been established, the NFIP rules require that the lowest floors of residential structures be elevated to or above the base flood elevation. One regulatory standard that could be implemented is requiring freeboard that is greater than the NFIP minimum requirement which does not include any freeboard. Freeboard is a term for an extra margin of protection. Currently, the State of Nebraska Minimum Standards for Floodplain Management state that all new construction and substantial improvements of residential structures shall have the lowest floor (including basement) elevated to or above 1 foot above the base flood level<sup>4</sup>. Ordinances or laws with a freeboard requirement add height above the base flood elevation to account for future flood fringe development, uncertainties inherent with the methodologies, lack of data, waves or debris that accompany the base flood, and floods higher than the base flood. A freeboard requirement means that new buildings will be protected to a level higher than the NFIP's base flood elevation.

The CRS credit calculation formula for freeboard credit is  $100 \times \text{FB}$ . For example, if the City of Lincoln required in all areas of the regulated 100-year flood plain that all new construction and substantial improvements of residential structures have the lowest floor (including basement) elevated to or above 2 feet above the base flood level and require that all new construction and substantial improvements of non-residential structures have the lowest floor (including basement) elevated to or above 2 feet above the base flood level or be flood proofed to a level no lower than 2 feet above the level of the base flood elevation, provided that all areas of the building (including mechanical and utility equipment) below the required elevation are watertight with walls substantially impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy, then  $100 \times 2 = 200$  credit points would be given for this activity.

### **Protection of Floodplain Storage Capacity**

Although a building constructed on fill and elevated above the base flood elevation meets the NFIP regulations, filling a substantial portion of the floodplain reduces storage for flood water and tends to increase peak flows downstream. Prohibiting fill, or requiring that if fill is placed in the floodplain, an equal volume of storage be made available, can reduce this problem.

The basic NFIP requirement in riverine situations is that new development must not restrict conveyance of flood waters. A floodway is adopted to identify the area needed to convey the base flood and that area is kept free of obstructions. The remaining portion of the floodplain, the flood fringe, may be filled or otherwise developed. The NFIP requirement does not account for the loss of floodplain storage caused by allowing the flood fringe to be filled<sup>2</sup>.

Floodplain storage can be maintained by prohibiting fill, building, or any other item that is displacing floodwater. This prohibition will prevent most floodplain development and will help preserve the natural and beneficial functions of the floodplain. Another way floodplain storage can be maintained is to require compensatory storage, i.e., the developer must compensate for each cubic fill, building, or other item that is displacing flood water. This can be accomplished by removing an equal volume of fill from the same lot, usually at the same elevation to maintain the same hydraulic conditions<sup>2</sup>.

The CRS credit for protection of floodplain storage capacity is 80 points where regulations prohibit fill within floodplains or flood fringes, including construction or buildings on fill, or 70 points where regulations require that new developments provide compensatory storage at hydraulically equivalent sites.

### **More Restrictive Floodway Standard**

If the community's floodways are based on the FEMA surcharge standard of 1.0 foot, then there is no credit for this element. If a community uses some other standard then credit can be assessed. Credit points are based on the allowable surcharge used in the study. The community must document that there is a maximum floodway surcharge allowed under local law. Table 2 lists the credit points available for different floodway surcharge standards.

**TABLE 1-MORE RESTRICTIVE FLOODWAY CREDIT POINTS**

<b>Credit Points Available</b>	<b>Allowable Surcharge (ft.)</b>
200	0.00
150	0.01-0.20
100	0.21-0.50
50	0.51-0.99

### **STATE AND COMMUNITY COMPARISON**

One of the primary problems of managing floodplains and watersheds subject to development is increased flood stages (or depths). The primary existing control on future flood stages is the NFIP floodway standard, which allows flood depths to be increased up to 1 foot above the 100-year floodplain elevation as a result of floodplain encroachments. The impacts of this 1-foot increase in the flood stage on existing properties and future construction are not considered under the NFIP<sup>5</sup>.

An overall management plan is essential and would include a technical analysis to quantify current and future conditions; it would incorporate mitigation techniques to minimize impacts; it would identify implementation measures to manage all of the hazard factors identified; it would include strong citizenship involvement so the plan is equitable; and it would ultimately provide a vision for future use of the community's land within and outside the floodplain<sup>5</sup>.

### **Tulsa, Oklahoma-Floodplain Management Program**

Tulsa, Oklahoma has a population around 400,000 people and its topography is characterized by broad valleys, hills, and plains with sand filled channels and active water courses occupying only a small portion of the river bed or flood plain. Tulsa, Oklahoma is rated as a Class 3 in the CRS program. This class designation allows for a 35% premium credit for flood insurance reduction. Tulsa's principles are that the urban environment and each watershed within it form a single, interacting system and actions have consequences; floodplain and stormwater management is a matter of time and space allocation; water requires space and must be stored and conveyed; floodplains and stormwater are resources and if they can become recreation or beautification assets, so much the better<sup>6</sup>.

Some of Tulsa's preventative policies include:

- Public park, recreation, and open space use of the floodplain is the best policy
- Regulatory systems are based on the 100-year flood under fully urbanized watershed conditions
- Requiring finished floors to be at least 1 foot above the regulatory flood elevation, based on the ultimate watershed
- Floodplain alterations should be avoided unless they are based on a basin master plan and it can be shown that they will not cause offsite problems
- Regulation of floodplain uses is based on the recognition that flooding is a public threat

- Floodplain uses should not reduce, restrict, or impede channel conveyance capacity, or increase downstream velocities. No changes can take place in the floodplain that decrease or reduce storage. If filling is allowed, compensatory storage must be provided in the floodplain.
- Stormwater runoff control is necessary because development on higher ground can increase flooding, siltation, and erosion
- Public acquisition of floodplain lands
- Disclosure of flood hazard information to purchasers and renters
- Flood alert, warning, and emergency management systems
- Public information, education, and awareness programs

City leaders saw the need for better maintenance when the 1984 flood swamped debris-choked creeks and channels, clogged and collapsed sewers. The resulting public and private costs were enormous. The flood triggered a search for stable, continual maintenance funding. In 1986 the city approved a drainage utility fee and now maintenance is an essential element of Tulsa's program. In 1980, the city spent about \$400,000 on stormwater maintenance and in 1993, the city was able to spend about \$6 million on stormwater maintenance. The system includes hundreds of miles of surface channels and floodplains, thousands of miles of underground sewers, public detention basins, pump stations, roadside ditches, bridges, and the curbs and inlet along the street system. Overall responsibility during emergencies lies with the city-county Tulsa Area Emergency Management Agency (TAEMA); but in flood management, TAEMA shares its lead with Tulsa's Public Work Department<sup>7</sup>.

The fiscal foundation of Tulsa's program is the stormwater utility fee. The fee was calculated by determining essential program requirements, then allocating the needed charges equitably to all homes and businesses. Residents of single-family homes pay \$2.58 per month and business owners pay the same amount for every 2,650 square feet of impervious surface on their properties<sup>7</sup>.

The charge is based on the theory that stormwater runs off every property in the city; dwellers on both the hillside and lowland contribute to runoff. Since everybody helps create the need for a floodplain and stormwater program, then everybody pays for it. The 1994-1995 utility fee yielded about \$9.5 million. The largest share goes to maintenance and the balance goes toward management, planning, public education, and small capital projects<sup>7</sup>.

### **DuPage County, Illinois-Floodplain Management Program**

DuPage County is a 336 square mile suburb west of Chicago that contains 40 municipalities. The population increased from about 155,000 to 782,000 (a 500% increase) from 1955 to 1995. Much of the urbanization occurred without consideration of stormwater or floodplain impacts. The accuracy of the floodplain maps was undermined by the impacts of urbanization. A major flood in 1987 led to the adoption of a stormwater management plan in 1989, with subsequent ordinances and watershed plans for implementation. The comprehensive and forward-looking nature of the County's plan is reflected in its six objectives<sup>5</sup>:

1. Reduce the existing potential for stormwater damage to public health, safety, life, and property.

2. Control future increases in stormwater damage within DuPage County and in areas of adjacent counties affected by DuPage County drainage.
3. Protect and enhance the quality, quantity, and availability of surface and groundwater resources.
4. Preserve and enhance existing aquatic and riparian environments and encourage restoration of degraded areas.
5. Control sediment and erosion in and from drainageways, developments, and construction sites.
6. Promote equitable, acceptable, and legal measures for stormwater management.

Some of DuPage County's preventative policies include:

- Compensatory storage equal to at least 1.5 times the volume of floodplain or depressional storage displaced; and provided at the same incremental flood frequency elevation as the flood storage displaced.
- Zero increases in floodplain elevations for all developments.
- Mitigation for any riparian function impacted by development.
- Variances for floodplain standards are not part of the zoning process.
- Floodplain mapping based on future development conditions, so that future development does not increase the runoff or flood elevations.
- One foot of freeboard above the 100-year flood elevations for all new structures even if built outside the floodplain.
- A wetlands banking program to insure a no net loss of wetlands<sup>5</sup>.

A review of tax valuation, population growth, and land use indicates that DuPage County's approach has not been a disincentive to economic development in the county. The comprehensiveness of the DuPage County Program is its greatest strength. Because the program sets a minimum countywide standard and has been consistent in regulatory, planning, engineering, and capital components, it has received strong county and municipal support<sup>5</sup>.

### **Charlotte-Mecklenburg, North Carolina-Floodplain Management Program**

The City of Charlotte and Mecklenburg County area (including six towns) is located in south-central North Carolina. In 1994, Charlotte-Mecklenburg initiated a stormwater management program, funded by a stormwater fee, to address infrastructure problems on private property and expand the existing floodplain management program. The Mecklenburg County Floodplain Management Guidance Document was adopted in 1997 and has served as a long-term business plan to guide Charlotte-Mecklenburg Storm Water Services in increasing the level of service to the community by meeting the following objectives<sup>5</sup>:

1. To prevent or reduce the loss of life, disruption of vital services, and damage caused by floods
2. To preserve and restore the natural and beneficial functions of the floodplains.

Some of Charlotte-Mecklenburg's preventative policies include:

- For NFIP purposes a 0.5' rise floodway surcharge is utilized.

- For local regulation, Floodplain Landuse Maps (FLUM) have been developed that incorporate existing landuse and a 0.1' floodway surcharge.
- Minimum finished floor elevations (FFE) of a new structure are based on the future development in the watershed to help protect new development from flooding. New development must be constructed a minimum of 1 foot above FFE.

An evaluation was completed for the Mallard Creek watershed to determine the cumulative impacts in the floodplain fringe. The results of this study indicate that based on the regulations adopted according to the 1970's FEMA maps, continued filling in the floodplain fringe could result in increases in 100-year flood elevations almost 2.5 feet<sup>8</sup>.

In November 1999, Charlotte-Mecklenburg adopted the Surface Water Improvement and Management Stream Buffer Ordinance (S.W.I.M.). This ordinance requires the establishment of buffers along Charlotte-Mecklenburg streams in order to protect the integrity of the stream system and ensure that streams and their adjacent lands fulfill their natural functions. In general, the S.W.I.M. Stream Buffer Ordinance requires forested buffers on streams draining 100 or more acres. A buffer is defined as the forested/vegetated area on both sides of the stream. The width of the buffer varies according to the size of the watershed<sup>9</sup>.

### **State of Montana-Floodplain Management Program**

The Montana Department of Natural Resources-Water Resources Division has enacted regulations to enforce proper floodplain management to reduce the potential for loss of life and property as well as degradation of natural resources.

Some of Montana's preventative policies include:

- The delineation of floodways is based on a 0.5' surcharge value.
- Residential structures must be constructed on suitable fill with a permanent foundation such that the lowest floor (including basement) level is 2 or more feet above the base flood elevation<sup>10</sup>.

### **CONCLUSIONS**

The City of Lincoln, Nebraska participates in the NFIP that is administered by FEMA. The NFIP's Community Rating System (CRS) provides insurance premium rate reductions to encourage communities to enact regulatory floodplain standards that are higher than the minimum NFIP requirements. Many communities throughout the United States have more restrictive regulatory standards in place that enable the community to wisely manage the floodplains and obtain insurance premium rate reductions for those structures in the community that have flood insurance. Many communities have established a utility fee that funds the community's floodplain management programs. There are many different regulatory standards that are higher than the minimum NFIP requirements that could be implemented in the City of Lincoln.

This study will include an analysis of the impacts that could result if no revisions to the current flood plain regulations are made. A 50% loss of flood storage will be modeled and a 1.0' rise in flood height due to development in the City of Lincoln along reaches in Salt Creek, Deadmans



Run, and Beal Slough will be evaluated. The evaluation will identify the economic impacts of the rise in flood heights and will delineate new flood boundaries based on the 50% loss of storage and a 1.0' rise in flood height. A 0.5' floodway will be modeled and delineated along a reach on Deadmans Run to determine the increase in floodway delineation from the current floodway delineation that uses a 1.0' surcharge.

## **REFERENCES**

1. 44 Code of Federal Regulations §59.2-October 1, 2000.
2. National Flood Insurance Program-Community Rating System Coordinator's Manual: Credit for Higher Regulatory Standards Section 430; The Federal Emergency Management Agency-January 1999.
3. National Flood Insurance Program-Community Rating System Coordinator's Manual: Introduction Section 110; The Federal Emergency Management Agency-January 1999.
4. Title 258-Rules Governing Floodplain Management: Nebraska Department of Natural Resources-January 1994.
5. No Adverse Impact: A New Direction in Floodplain Management Policy; Larson and Plasencia-June 2001.
6. Tulsa Oklahoma, Policy Framework-Watershed Management;  
<http://www.sustainable.doe.gov/articles/rooftop/policies.shtml>
7. Tulsa Oklahoma, Policy Framework-Watershed Management;  
<http://www.sustainable.doe.gov/articles/rooftop/program.shtml>
8. 1999-2000 Floodplain ReMapping Efforts-Charlotte-Mecklenburg Floodplain Summary Report; <http://www.co.mecklenburg.nc.us/coeng/Storm/floodinfo/floodmaps.htm>
9. Charlotte-Mecklenburg-Storm Water Improvement and Management (S.W.I.M.) Stream Buffers-Information and Resources Pamphlet-Mecklenburg County; January 2000.
10. Chapter 15-Floodplain Management Engineering Bureau-Floodplain Rules: Montana Department of Natural Resources and Conservation; October 1989.